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THE BOTANICAL GAZETTE

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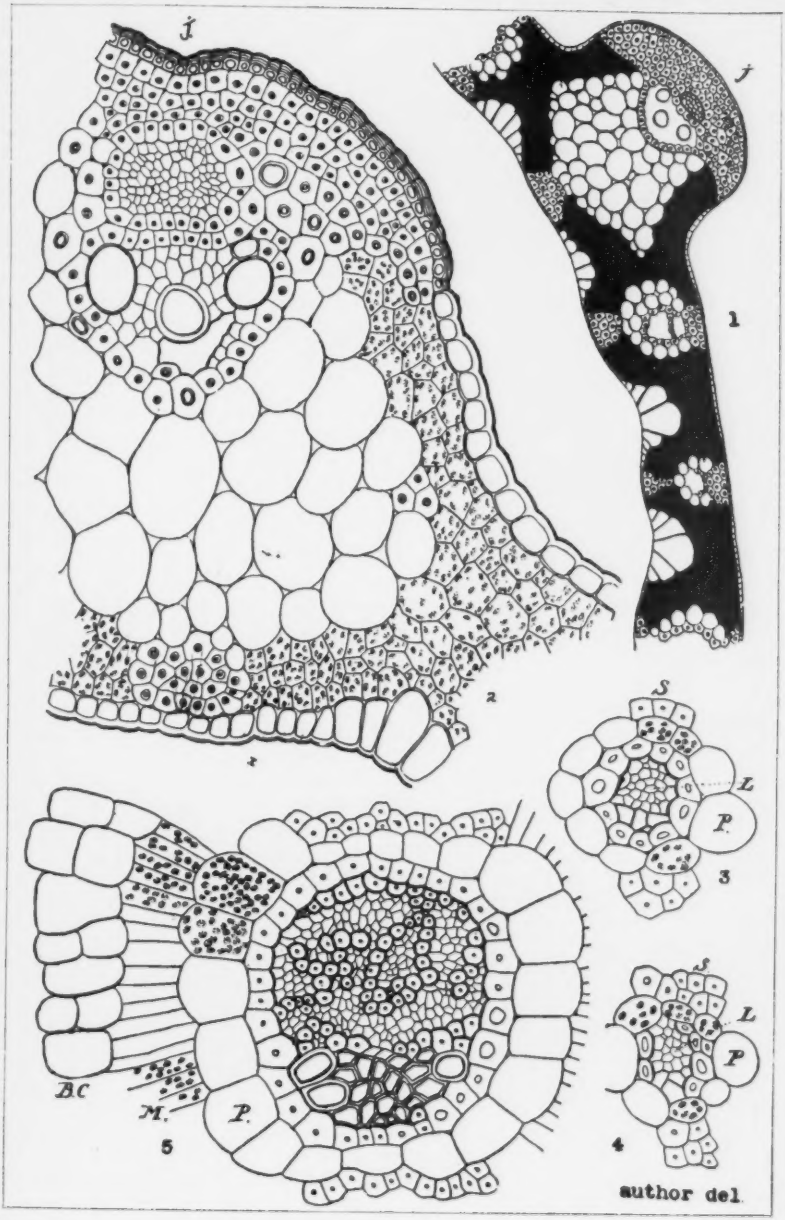

HOLM on UNIOLA.

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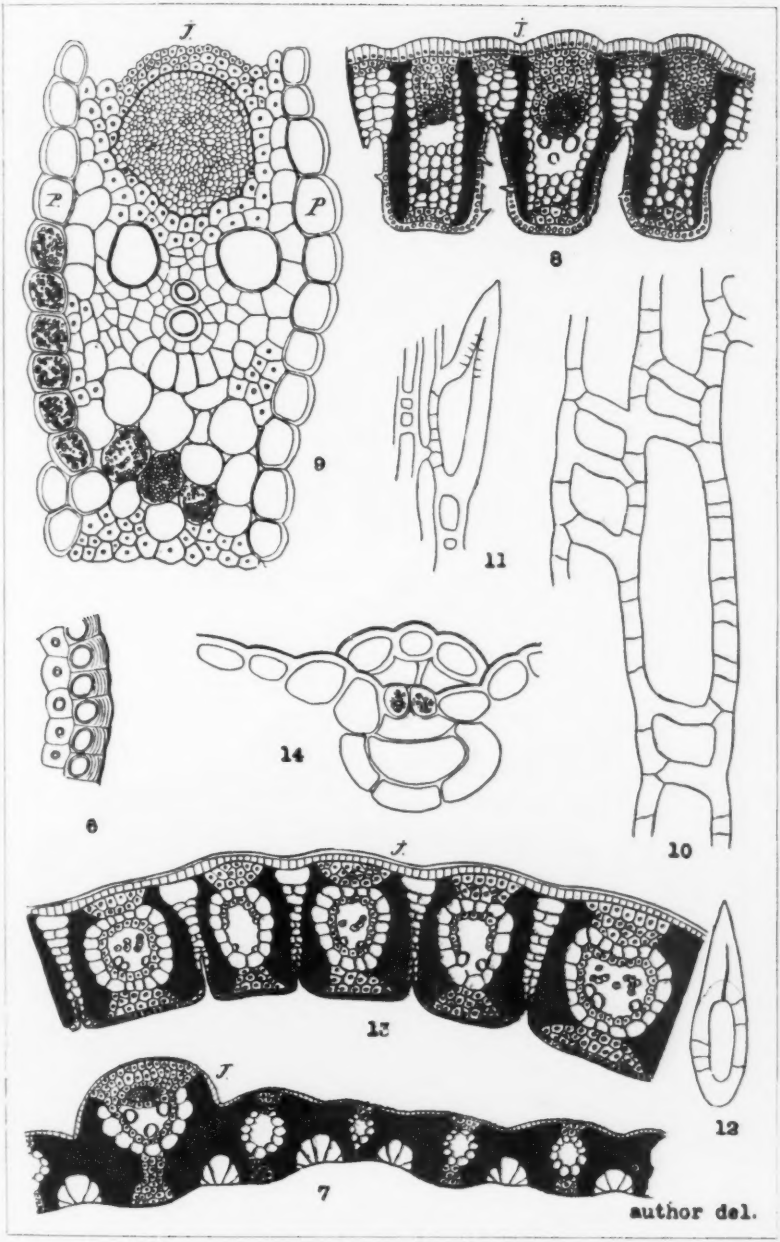


HOLM on UNIOLA.

VOL. XVI. NO. 8.—BOTANICAL GAZETTE.—AUG., 1891.

A study of some anatomical characters of North American Gramineæ. II.

THEO. HOLM.

The genus Uniola.

(WITH PLATES XXI AND XXII.)

Uniola gracilis Michx., *U. nitida* Baldw., *U. paniculata* L. and *U. Palmeri* Vasey.—These four species form together two groups, the first two on the one and the last two on the other side, on account of differences in the anatomical structure of their leaves. It was also to be supposed so, since they inhabit localities so very different. The first group occurs in the woods or swamps, while the second one grows on the sand hills on the sea shore. We shall now see how they differ from each other and from the species described in the preceding part of this paper, U. latifolia, an inhabitant of shaded slopes.

Epidermis.—The epidermis in U. gracilis and U. nitida agrees in most respects with that of U. latifolia, and the only essential difference consists in the presence or absence of long hairs and thorn-shaped expansions; U. gracilis shows the presence of both organs on the superior face of the blade, but in smaller number than observed in U. latifolia. In U. nitida these organs are entirely wanting.

The cells of epidermis which cover the stereome on the inferior face are strongly thickened and laminated in U. gracilis and U. nitida (plate XXII, fig. 6), which shows a difference from what we have seen in U. latifolia. The bulliform cells and the stomates show, however, nearly the same structure and distribution. But in U. paniculata and U. Palmeri the epidermis is entirely different; the cells on both faces are strongly thick-walled and porose (plate XXII, fig. 10), rectangular or quadrangular, and arranged so that there is either one short cell between two long ones, as in U. Palmeri, or even three short between two long ones, as has been observed in U. paniculata.

No hairs are present in these two species, but numerous sharply pointed and porose spines (plate XXII, figs. 11–12) proceed from the superior face of the leaf of U. paniculata,

while in U. Palmeri the epidermal expansions are merely represented by wart-shaped, obtuse organs. The epidermis of the inferior face is on the contrary entirely smooth in these two species.

Stomates are present on both faces, but especially on the margins of the deep sinuses of the superior face, in the strata which border on the bulliform cells; these stomates show in U. paniculata the normal aspect, but in U. Palmeri they are slightly depressed below the general surface (plate XXII, fig. 14), and surmounted by wart-shaped expansions from the epidermis in groups of as many as seven. The bulliform cells of U. gracilis and U. nitida agree very well with those described for U. latifolia; in U. paniculata and U. Palmeri they form only very small groups, but are here in contact with a large mass of uncolored parenchyma.

Mestome-bundles.—The arrangement of these is easily to be seen, if the sections figured in the accompanying plates are examined. Plate XXI, fig. 1 shows a section of the median part of the blade of U. gracilis; plate XXII, fig. 7, a similar section of U. nitida; fig. 8 of U. paniculata; and fig. 13 of the female plant of U. Palmeri. It must be remarked here that the anatomical structure of the leaf of the male and female plant of U. Palmeri is identical.

The carene in U. gracilis and U. nitida is occupied with but a single mestome-bundle, whereas there were several in U. latifolia. In U. paniculata and U. Palmeri there is no carene and the median nerve is not different in any respect from the largest ones in the whole blade. Furthermore there are no mestome-bundles between the groups of bulliform cells and the epidermis of the inferior face, as was the case in U. latifolia.

The minute structure of the mestome-bundles in U. gracilis and U. nitida is the same. There is a thin-walled parenchyma-sheath around the entire bundle, uncolored in the midrib or partly green in the other ribs. Sometimes, as for instance in the large bundles excepting the median one, the parenchyma-sheath has a few thick-walled cells, where it is in contact with the stereome. But besides this, the proper sheath is also to be seen and inside this another one, which consists of very thick-walled cells, forming in the largest bundles, those of first degree, a closed sheath around the leptome and the hadrome. This inner sheath is also present in the smaller bundles, but is here more or less interrupted

(plate XXI, fig. 4). In U. latifolia there is present a thick-walled parenchymatic tissue between the leptome and hadrome, and the same is also to be observed in U. gracilis and U. nitida, at least in the largest bundles. But neither this stratum nor the inner sheath of thick-walled cells may be considered as indicating any mestome-sheath; they merely represent a mestome-parenchyma for the same reason as mentioned for U. latifolia.

The mestome-bundles show, as in U. latifolia, three different forms depending on their strength and development. Those of the first degree have a closed inner sheath besides a layer of similar thick-walled cells between the leptome and hadrome, while in those of the second degree the leptome and hadrome are in contact with each other. In the smallest bundles there is no closed inner sheath of thick-walled cells, but merely an interrupted layer on the leptome side, and the leptome and hadrome are in immediate contact with each other. The leptome and hadrome, considered by themselves, show the strongest development in the largest bundles, those of the first degree.

As to the distribution of these different forms of mestome-bundles in the entire blade, I do not dare try to give any formula, as has been done in U. latifolia. There seem to be too many variations, especially on comparing leaves of specimens from different localities, but it may be said with good reason that the bundles of the second degree are the most numerous in the whole blade, while the largest ones are present in a relatively small number.

On examining the mestome-bundles in U. paniculata and U. Palmeri, there will be seen a rather important difference in structure from what has been shown above. The proper parenchyma-sheath is thin-walled in both species, but contains large deposits of starch in U. paniculata (plate XXII, fig. 9) and forms a border between the entire mestome-bundle and the mesophyll on both sides. In U. Palmeri (plate XXII, fig. 5) on the contrary it does not contain starch and forms an annular sheath around the whole bundle, not extending to the epidermis on either of the two faces.

There is in the largest bundles of U. paniculata a closed sheath of thick-walled parenchyma around the leptome, while in U. Palmeri both the leptome and hadrome are surrounded by a similar sheath, besides which the leptome contains several groups, more or less isolated, of very thick-walled cells.

Although not strictly belonging to the mestome-bundles, it may be mentioned here, that there is in the U. paniculata a quite considerable tissue of large-celled parenchyma between the hadrome and the stereome of the superior face, and this parenchyma contains starch, like the surrounding sheath.

We shall also find in these two species a certain difference as to the development of the mestome-bundles, as described for the preceding species. U. paniculata shows two degrees, the first one as described above; the second is on the contrary characterized by having the leptome and hadrome in contact with each other. U. Palmeri shows, besides the form of the first degree described above, a second one, in which the inner sheath is reduced to a horse-shoe shaped layer on the leptome side, besides a few thick-walled cells between the leptome and hadrome but none in the leptome itself.

These layers of thick-walled cells in the mestome-bundles of U. paniculata and U. Palmeri, whether they form a closed sheath or not, are identical with those mentioned for the preceding three species, as representing a mestome-parenchyma; the same is the case with the groups of similar cells, which we have seen in the leptome of U. Palmeri. Concerning the distribution of these different mestome-bundles in the U. paniculata and U. Palmeri, those of the second degree are the most numerous, but no rule can be given as to their situation between the larger ones.

The stereome.—This forms in U. gracilis and U. nitida two groups, one above and one below each mestome-bundle, and shows only very small differences. In U. gracilis the stereome of the superior face of the carene is widely separated from the mestome-bundle by a large tissue of uncolored parenchyma, while in U. nitida it borders immediately on the parenchyma-sheath. It forms as in U. latifolia a nearly triangular group on each margin of the blade. Nearly the same arrangement is found in U. paniculata, in which there is one group above and below each mestome-bundle. In this the stereome of the superior face is widely separated from the mestome-bundle by the parenchyma, which has been described above. Small groups of stereome are also to be observed inside the proper parenchyma-sheath of this species (plate XXII, fig. 9); it seems as if these thick-walled cells belong to this element, the stereome, rather than to the hadrome.

Finally U. paniculata shows groups of stereome opposite the bulliform cells, separated from these by an uncolored tis-

sue of parenchyma. U. Palmeri has not these last mentioned stereome-groups opposite the bulliform cells, but merely one above and one below each mestome-bundle, both of them bordering on the parenchyma-sheath.

Besides these groups of stereome, there is also one large group on each of the two margins of the blade of both U. paniculata and U. Palmeri.

The mesophyll.—This tissue is most extensive in U. gracilis and U. nitida, where it forms broad layers of rather large cells between the mestome-bundles and is in contact with epidermis on both faces. It is relatively but sparingly represented in the two other species, and is here not only separated by the mestome-bundles with their corresponding groups of stereome, but also by the broad layers of uncolored parenchyma. Thus there is one two isolated group of mesophyll on each side of the mestome-bundles. The cells of this tissue are, in U. paniculata and U. Palmeri, rectangular, very narrow and thin-walled.

The uncolored parenchyma.—This is very distinct in the carene of U. gracilis (plate XXI, fig. 2), where it occupies a large space between the mestome-bundle and the superior epidermis. There is also in this same species a single stratum of uncolored cells outside the parenchyma-sheath of the two mestome-bundles next to the midrib and bordering on the carene (plate XXI, fig. 1). This parenchyma is also present and relatively much more abundant in U. paniculata and U. Palmeri, where it forms large groups between the bulliform cells and the epidermis of the inferior face.

From the foregoing it will be seen that these five species of the genus Uniola show several anatomical characters in their leaf-structure by which they may easily be distinguished. These characters may be summarized as follows:

Epidermis.

Large cells in alternation with small ones	U. paniculata. U. Palmeri.
Long hairs on the superior face	U. latifolia. U. gracilis.
Thorn-shaped expansions on the superior face	U. latifolia. U. gracilis. U. paniculata.
Wart-shaped expansions on the superior face	U. Palmeri.
Bulliform cells forming large groups	U. latifolia. U. gracilis. U. nitida.

Bulliform cells forming smaller groups	U. paniculata. U. Palmeri.
Stomates depressed, surmounted by epidermal expansions	U. Palmeri.

Mestome-bundles.

One buudle between each group of bulliform cells and the inferior epidermis	U. latifolia.
Leptome and hadrome surrounded by a sheath of thick-walled parenchyma in the large bundles	U. gracilis. U. nitida. U. Palmeri.
Only the leptome surrounded by thick-walled cells	U. latifolia. U. paniculata.
Groups of thick-walled parenchyma in the leptome	U. Palmeri.
Parenchyma sheath containing starch, extending from the superior to the inferior epidermis, not forming any annular sheath around the bundle	U. paniculata.

Mesophyll.

Separated by groups of uncolored parenchyma	U. paniculata. U. Palmeri.

Stereome.

Six isolated groups on the superior face of the carene	U. latifolia.
One group opposite the bulliform cells	U. paniculata.
Isolated groups inside the parenchyma-sheath	U. paniculata.

Uncolored parenchyma.

One large group in the carene	U. latifolia. U. gracilis.
One group between the mestome bundles	U. paniculata. U. Palmeri.

U. S. National Museum, Washington, D. C.

EXPLANATION OF PLATES.

PLATE XXI.—Figs. 1–4. *Uniola gracilis.*—Fig. 1. Transverse section of leaf. × 37.—Fig. 2. Transverse section of the median part of the leaf, the carene; the inferior face of the leaf at *I.* × 160.—Figs. 3 and 4. Transverse sections of two small mestome-bundles. Fig. 3 shows a closed sheath of thick-walled parenchyma-cells inside the proper parenchyma sheath *P.* *L.*, the leptome: *S.*, the stereome on the inferior face of the leaf. In fig. 4 the inner sheath is not complete, but merely represented by two groups of thick-walled cells. × 200.

Fig. 5. *U. Palmeri.* Transverse section of a large mestome-bundle. On the left side in the figure are the bulliform cells to be seen at *B*, *C*, and the mesophyll at *M*. Several thick-walled parenchyma cells are to be observed in the leptome and there is a closed sheath of similar cells inside the proper parenchyma-sheath *P.* × 320.

PLATE XXII.—Fig. 6. *U. gracilis.* Epidermis, taken from the carene, transverse section. × 560.

Fig. 7. *U. nitida.* Transverse section of leaf; the inferior face at *I.* × 74.

Figs. 8–12. *U. paniculata.*—Fig. 8. Transverse section of leaf; the inferior face at *I.* × 60. Fig. 9. Transverse section of a large mestome-bundle. The proper parenchyma-sheath, *P.* contains starch, figured in a few of the cells, as

does also the large parenchyma cells between the mestome and the stereome of the superior face. The leptome is enclosed by layers of very narrow cells and separated from the hadrome. × 240. Fig. 10. Epidermis of the inferior face. × 560. Figs. 11 and 12. Thorn-shaped expansions from the superior epidermis, seen from the side and from above. × 240.

Figs. 13 and 14. *U. Palmeri.*—Fig. 13. Transverse section of leaf. × 74. Fig. 14. Stomate from the inferior face, transverse section. × 320.

Notes on Uredineæ.

J. C. ARTHUR.

Puccinia Stipæ is variously cited by different writers. Dietel[1] writes *P. Stipæ* Opiz, and considers the American form, heretofore called *P. Stipæ* Arthur, identical with it. In Sydow's Uredineen, fascicle I, No. 28, it is given as *P. Stipæ* (Opiz) Hora, and is so spoken of by Magnus[2] in a notice of the publication.

Opiz[3] made use of the name in a list of Bohemian plants, in which no characterizations or notes of any kind are given. It was not used as a specific name, but for a sub-form of a variety of P. Graminis. The full name reads *Puccinia Graminis* Pers., c *foliorum* Opiz, *β Stipæ* Opiz. The host is not mentioned, but it was presumably a Stipa, and quite possibly S. capillata, on which the rust was gathered in 1888 by Paul Hora in the region covered by Opiz's list. Whether a description of the species has been published by Hora or not the writer does not know, but if so it probably did not antedate the publication in America.[4] The name correctly written would therefore be *Puccinia Stipæ* (Opiz) Arthur.

Puccinia ornata was first published as the name of a Leptopuccinia on Rumex[5] in 1887, and consequently the later application of the specific name to another Puccinia by Harkness[6] calls for correction. It would be a pleasure to dedicate this interesting form to the discoverer, if another

[1] Hedwigia, xxviii, (1889, p. 187).
[2] Hedwigia, xxviii, (1889, p. 94).
[3] Seznam Rostlin Kvetěny Ceské, 1852, p. 138.
[4] Arthur, Preliminary List of Iowa Uredineæ, in Bull. Iowa Agric. Coll., Nov. 1884, p. 160.
[5] Report of botanical work in Minnesota, in Bull. No. 3, Geol. Surv. Minn., 1887, p. 30.
[6] Proc. Cal. Acad. Sci., 2nd. Ser., ii. 1889.

species of the genus did not already bear his name. The name **Puccinia medusæoides** is therefore proposed for it, from the resemblance of the branched pedicel of the teleutospores to that of Spegazzini's *P. Medusa.*

Uromyces perigynius has an error in the description as originally published in Journal of Mycology, v. p. 11, to which my attention has been directed by Mr. E. W. D. Holway. The measurements of the teleutospores, as there given, should be multiplied by three, making the true dimensions 12–18 × 24–30μ.

The teleutospores found upon the leaves do not, as a rule, have the apex long and pointed, but more or less rounded, and the spore correspondingly shorter.

Dietel[7] demonstrated that *Uromyces Caricis* Peck, is the uredo of a Puccinia, which he called *P. Caricis-strictæ* D., and remarked that no true Uromyces upon Carex is known. A month afterward *U. perigynius* Halst. was published, and it appears to be a true Uromyces. No mention in the original description is made of the uredo form, but I have received from Mr. E. W. D. Holway excellent material collected in August, 1887, upon the leaves of *Carex pubescens*, bearing both uredo- and teleutosori. The uredospores are globose, epispore thin and echinulate, 15–18μ in diameter, with occasionally a spore measuring 22–28μ. The uredospores possess two or three lateral germ-pores, while the teleutospores have a single terminal germ-pore. This pore is not easily demonstrated in most cases, even with the use of sulphuric acid. Any doubt of its presence, however, is put to rest by a specimen collected by the writer, in Indiana, upon a Carex that is probably C. pubescens. It was found in May upon the leaves of the preceding season's growth. Most of the teleutospores in this specimen have the terminal pore distinctly open, from having already germinated without dropping out of the sorus.

Coleosporium Viburni was established upon the uredo form alone. Teleutospores have since been gathered upon the same host, *V. Lentago*, at Racine, Wis., by J. J. Davis. The sori are hypophyllous, scattered, yellow; teleutospores cylindrical, or elongated clavate, three- or four-locular, smooth, 20–30 × 65–90μ.

Puccinia Cyperi n. sp.—Sori irregularly scattered upon effused brown spots on the culms and under surface of foliage

[7] Hedwigia, xxviii (1889), p. 22.

and involucral leaves, oblong, long covered with thick epidermis; uredospores elliptical or nearly round to obovate, epispore thin, echinulate, 19–22 × 20–30 μ; teleutospores brown above and pale below, elongated oblong, little if any constricted, vertex strongly thickened, obtusely and obliquely pointed, epispore thin, smooth, 17–20 × 33 × 63 μ; pedicel short, one-third the length of the spore or less, slightly colored.

On *Cyperus Schweinitzii:* Iowa, E. W. D. Holway, J. C. Arthur; Nebraska, H. J. Webber, in *Flora of Nebraska*, No. 369; Wisconsin, W. Trelease and L. H. Pammel, in *Paras. Fungi of Wis.*, No. 202. On *Cyperus strigosus:* Michigan, J. C. Arthur.

This species is related to *P. obtecta*, and in the form of its teleutospores also resembles *P. Caricis*, to which it has been referred.

Uromyces Gentianæ n. sp.—Sori scattered over the green parts of the host, oblong or round, soon naked, brownish-yellow color; uredospores globose or ovoid, epispore thin, echinulate, 18–20 × 19–25 μ; teleutospores globose or ovoid, yellowish-brown, vertex rounded, slightly thickened, epispore thin, obscurely papillate, 15–19 × 19–23 μ, pedicel fragile, very short.

On *Gentiana quinquefolia* var. *occidentalis*, Decorah, Iowa, E. W. D. Holway.

The teleutospores are almost the same size and color as the uredospores, and quite different from the one-celled teleutospores of *Puccinia Gentianæ*. That these are genuine teleutospores is certain from the presence of a terminal pore, which shows very distinctly upon using sulphuric acid. Their close resemblance to the uredospore has caused them to be overlooked heretofore. The uredospores are sometimes thickened like the teleutospores, but the spot is always lateral, and not terminal, and by using acid the two or three lateral pores can be made visible.

Purdue University, Lafayette, Ind.

A sketch of the flora of Orono, Me.

F. LAMSON-SCRIBNER.

[The writer desires to have the facts embodied in the following paper, prepared in 1872 and hitherto unpublished, placed on record for the use of those who may hereafter compile the flora of Maine.]

An account of the flora of any region is valuable as indicating the local distribution of plants—a matter of much interest to the botanist and agriculturist. The geographical range of species is thus established. A knowledge of the plants of a locality enables one to form a very correct opinion of its climate and the nature and condition of the soil. On the other hand, the climate and physical features of a locality form an index to the variety and nature of the plants which may there be found. The extreme northeastern position of this locality renders it of more than ordinary interest.

The physical characters of this region are such as to afford a large number of species, and I very much regret that the list here presented is a so meager. It is to be hoped that the work thus begun will be rapidly advanced by the students of the College, in order that we may soon possess a complete list of the Phanerogams and Vascular Cryptogams of this entire region. The Mosses and Lichens have not yet been worked up. Of these lower, yet vastly interesting families this section certainly presents a rich field. Future researches will not only add much to our knowledge of those species already observed, but largely increase the list now made.

Almost every variety and condition of soil found in our latitude—except that of the seashore and high mountains—is to be met with here. The Stillwater branch of the Penobscot river flows close by the College front, and a mile in the opposite direction flow the rapid waters of the main river. Species delighting in sandy and rocky river banks find along these waters congenial homes. There are extensive meadows and upland glades; numerous streams of varied character; deep sphagnous and grassy swamps of larch, spruce and cedar. There are high rocky deciduous woods; steep gravelly hills and sandy fields; several ponds or lakes with both sandy and muddy shores, and an almost unlimited extent of mossy bog-land.

With all these varied conditions one may reasonably expect an extensive and interesting flora. Only a small portion of this territory has been thoroughly examined, and no

one locality visited throughout the entire season. The blooms of the month of August have been but partially observed, that being the month of the summer vacation. It has been my good fortune to examine the floras of Manchester and Waterville of this State; as compared with these the region of Orono and vicinity is much more interesting botanically, being peculiarly rich in rare and local species. Several localities, visited but once or twice, have appeared very interesting, and may, when more thoroughly explored, yield many rare and pleasing species.

Such a locality is the one near Pushaw mills, on the river about two miles above Stillwater village. This place was visited in June, last season, and we were rewarded by finding several species new to our list, one of rare interest. The water at this place rushes rapidly over a rocky bed, and the west bank is formed by a high precipitous cliff, on which specimens of the Sand Cherry (Prunus pumila L.) were found. This, our smallest species of the cherry tribe, is a little trailing shrub growing over the sand and rocks, rarely attaining the height of sixteen inches. Growing in abundance close by the bank were Aquilegia Canadensis L., Potentilla tridentata Ait., and the small purple Houstonia (H. purpurea L., var. longifolia Willd.). Out from the perpendicular walls of the cliff there was growing a pretty little fern, which was too immature for identification. But the chief interest of this locality is that it produces Arabis Drummondii Gray, the upright slender stems standing out from the bare rock walls, wherever there is a possibility for its fibrous roots to penetrate and find foot-hold. This is a rare, and, on account of its pale glaucous leaves and rose white flowers, a very attractive Crucifer. Although uncommon, this species has a wide geographical range, extending from Maine to Oregon. Astragalus alpinus L., an exceedingly pretty leguminous plant which grows on a small rocky island in the Kennebec river opposite Waterville, may be looked for here. Coming back to the College from the place we have just been describing I found numerous specimens of Carex Houghtonii Torr., growing on the grading of the Orono and Stillwater Railroad near the town bridge at the last named place. The Rev. J. Blake has collected this Carex at Medford. Another locality which has been visited but once (July 1870) is Nickol's Stream which flows through an extensive bog and forms the outlet of a pond of the same name in the town of Bradley.

The plants which characterize the place, as observed upon one hasty trip, are Lycopodium inundatum L., Eriophorum alpinum L., Limnanthemum lacunosum Griseb., Carex rostrata Mx., and Spartina cynosuroides Willd. This last species was found just by the outlet of the pond. The Lycopodium is a dwarf species from one to three inches high. It was growing on muddy soil close by the waters of the stream. Last season I found the same species growing on a bog in Manchester. It is quite rare, and valuable for exchanges. The enthusiastic student would be well repaid by a visit to this stream.

An excursion was made to Pushaw Lake in June, 1870, and the following species noted: Lobelia Dortmanna L., Nuphar luteum Smith, var. pumilum, Pontederia cordata L., Brasenia peltata Pursh., Eriocaulon septangulare With. Near the lake, Potentilla palustris Scop. was found in abundance. Along the way to the lake specimens of Smilacina trifolia Desf. and Phalaris arundinacea were collected.

About three miles southwest from Orono village there is a large bog, where are found nearly all the plants common to such localities. The main road from Stillwater to Bangor passes through this, making it easy of access. From here most of the bog plants of the College herbarium were obtained. The last of April or early in May we go to this locality for Symplocarpus fœtidus Salisb., Cassandra calyculata Don, and Andromeda polifolia L. It is here too that we find the Lonicera cœrulea L. and later in the season Arethusa bulbosa L., Calopogon pulchellus R. Br., Pogonia ophioglossoides Nutt. and Habenaria blephariglottis Lindl., four of our prettiest Orchids. The Pitcher Plant (Sarracenia) luxuriates here in the damp Sphagnum, opening its odd flowers with deep purple, fiddle-shaped petals and umbrella-like style, about the middle of June. Among the species of this bog we mention the species of Osmunda and Eriophorum, Menyanthes trifoliata L., Carex pauciflora Lghft., C. chordorhiza Ehrh., C. lacustris Willd., and many other species of Cyperaceæ.

In the woods which lie in a direct line from the College to the bog here spoken of, known as Bennock's woods, there were collected last summer (1873) many specimens of Calypso borealis Salisb., a rare and most beautiful Orchid. In one small spot, not more than 2 feet square, the writer observed nearly one hundred specimens in full bloom! A more pleasing or beautiful sight can hardly be imagined. A few specimens of the Calypso have been found in the swamp east of

the Colleges. It has also been seen in considerable numbers in the woods opposite the "Trotting Park." In Bennock's woods above mentioned, I gathered in 1871 a number of specimens of Botrychium simplex Hitch. In 1870 this plant was observed in the low fields between the house formerly occupied by Prof. Peckham, and the river.

An exceedingly rich and interesting locality, botanically considered, is the region below Basin Mills, extending down by the river and along the railroad for two or three miles. Here we find a great variety in the nature and condition of the soil, producing many species. Upon a high and gravelly bank less than half a mile below the Basin, near John McPheter's brook, grows a rare and elegant vine, Clematis verticillaris DC. It is a more delicate plant and prefers a drier soil than its near relative, C. Virginiana L. It is by far the prettier species, however; in fact it well deserves to stand first, as regards ornament, among our native climbers. The showy bluish purple petals of the flower expand two or three inches. It blooms from the middle to the last of May. The flowers are followed by the rather pretty plumose fruit. It is easily cultivated and is worthy a place among our handsomest foreign vines. By the rocky bank of a railroad cut, perhaps two miles below the mills, we find another beautiful native climber, called Wax-work or Bittersweet, Celastrus scandens. It receives its first name on account of the waxy aspect of the fruit, which in autumn presents a most brilliant appearance. Near where the Bittersweet grows there is found an abundance of the bright Saxifraga Virginiensis. Along by the railroad we find the pretty Corydalis glauca. Near the railroad there is a bog-marsh where delights the Calla palustris. Upon the bog we find Carex irrigua, one of the most attractive of the Carices.

About a mile below the mills there is a slow muddy stream where grows Nuphar advena. In a thicket close by this stream we find rather an uncommon species of Trillium (T. recurvum), which conceals its white or sometimes pinkish flower beneath its trio of leaves. Upon the dry banks near by Pedicularis Canadensis abounds, with its long, finely cut leaves, which are often of a deep purple color, and very handsome. Two miles, or perhaps two and a half miles below the mills, there is a rich marshy spot where in May we are attracted by the bright golden flowers of Caltha palustris. This is also the locality of Thaspium aureum and Archangelica atropurpur-

ea. On the shaded banks near at hand grow the large yellow Viola pubescens and Thalictrum dioicum L. Just below the mills in early spring may be observed the large coarse plaited leaves of Veratrum viride Ait. This locality also contains Nemopanthes Canadensis, Cassandra calyculata, Rhodora Canadensis, Ledum latifolium, Kalmia glauca and K. latifolia.

On the island at Basin Mills Arctostaphylos Uva-ursi Spreng., Houstonia purpurea, var. longifolia Gray, and Oryzopsis Canadensis may be found. Veronica Buxbaumii Tenore was collected on the high bank between Orono village and Basin Mills, just above "Cold Spring."

In a swamp in Bradley on the left hand side of the road going to Nickol's Stream, grows the most showy and beautiful of the Lady's Slippers, Cypripedium spectabile. With this Cypripedium are found Habenaria hyperborea and Listera cordata. The latter delicate and inconspicuous little orchid also abounds in the swamp just east of the College.

We now come to consider a few of the more interesting plants found immediately about the College. The Calypso has already been alluded to as having been observed near here. In the field in the rear of the new barn, specimens of Ophioglossum vulgatum were gathered in 1872. In the clearing in the same direction Nardosmia palmata grows in great abundance. I have observed this plant growing sparingly in Manchester. Dr. Goodale speaks of its being common in swamps near the Canada line on the "Canada Road." It is by no means a rare plant in this neighborhood. In some places it is as abundant as Erechthites on newly burnt land. This plant blooms the first of May, and is quite a puzzle for beginners, not only on account of its Composite character, but because the palmate leaves (whence the specific name) do not appear till late in the season.

Specimens of Aralia quinquefolia have been collected in the woods near the "Trotting Park." Vaccinium Canadensis Kalm abounds just east of the College. It is distinguished by its low growth and pubescent leaves, better known, however, by its rich, sweet berries. The following Orchids are found in the woods back of the College: Habenaria Hookeri Torr., H. orbiculata Torr., Spiranthes cernua Rich., S. gracilis Big., Corallorhiza innata R. Br., C. multiflora Nutt., Goodyera repens R. Br., G. pubescens, R. Br., Listera cordata R. Br., Calypso borealis Salisb., Cypripedium parviflorum Salisb. C. acaule Ait

The kinds of trees composing these woods are hemlock, fir, spruce, poplar, pine, maple, birch, beech, etc. The woods about the College are thus of a mixed growth, coniferous trees and soft wood predominating. The forests west and north on rocky uplands have more hard wood species. The forests are all second growth and none of the trees are of large size. Hard woods suitable for lumbering purposes are very scarce. The same is true of pine. The sugar maple occurs, but not in sufficient abundance to make sugar-making a paying business.

Acer dasycarpum Ehrh. grows along the banks of the river between Stillwater and Orono villages. It is a tree of large growth and often maintains a majestic, if not a magnificent appearance. It is distinguished from A. rubrum L. by the silvery whiteness of the under surface of the leaves, whence the trivial name. The branches are large and gradually expanding as they ascend, often becoming recurved somewhat in the manner of the elm. The wood is soft and fine grained, of moderate strength and perishable.

By the river in front of the College we find Viola lanceolata and Ranunculus Flammula, var. reptans. Potentilla palustris and Campanula aparinoides are found in the meadow below the farm house. On the side of the river opposite from the farm house there grow two very attractive vines, Calystegia sepium and Apios tuberosa. During the past season there was found along this bank the noble Ostrich Fern (Struthiopteris Germanica Willd.).

The variety of grasses upon the farm are those of common occurrence though there is a greater predominance of the better sorts. The bits of swale land, which are few, contain the ordinary sedges and species of Glyceria. The chief grasses which form the hay crop are timothy and red top with occasional plants of brown top or fowl meadow grass. With this hay there is mixed a small proportion of several kinds of clover. The forage plants which have been introduced by the present farm Superintendent are Hungarian millet and Alsike clover.

There are but few weeds found in Maine which have not been observed growing upon the College premises. Last season there was detected in a grain field a weed which the writer at least had not before observed, viz.: Camelina sativa Crantz. Darlington says this plant was introduced with flax, and remains as weed where the culture of that plant has been

abandoned. There is much danger of new weeds being introduced with the seeds or roots of plants received upon the farm from the Patent Office and elsewhere. Those weeds which give the most trouble are barn grass, rag-weed, purslane and couch or witch grass. The number of species in the College herbarium is 316, representing 66 orders. This does not include several species undetermined, nor the Compositæ, Salices, Juncaceæ, Cyperaceæ, and Gramineæ, and only a portion of the higher Cryptogams. The actual number of species observed, aside from the families mentioned, is 455.

Orono, Maine, 1872.

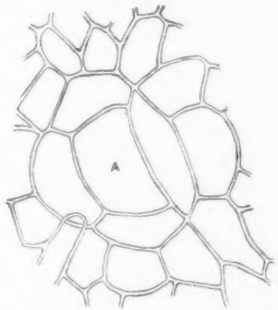
BRIEFER ARTICLES.

Notes on the pollination of Helianthus.—Having had growing in my room for some months a specimen of Helianthus annuus, I have observed its habits closely to see if I could find something new or interesting. Nothing out of the ordinary was observed until it came to bloom, which it did in March, bearing a single head. During this period I observed it very closely, from the time of the opening of the first disk floret until the last had withered away. Most of the flowers behaved in the usual way, the style pushing out the pollen from the stamen tubes and cross fertilization was insured by protandry. But in a number I noticed movements, to me quite new and interesting.

The styles in these cases appeared as usual and soon spread their tips for the reception of pollen. After standing in this way for about two days I was greatly surprised to see that they were being drawn back into the stamen tube. This they continued to do until they finally disappeared. Then the stems were forced to one side and from between the filaments were seen the bent styles slowly backing out, resembling very much the extraction of the plumule from the acorn in germination. This it continued to do until the entire style was withdrawn, leaving the stamens wilted and collapsed lying upon the limb of the corolla. Then the style assumed an erect position, spread its tips and apparently stood waiting to receive pollen. This entire act was accomplished in about a dozen cases; failed to more than draw back into the stamen tube in about as many more; and in two the style was broken in attempting to escape. All this was observed only in the outer circle of tubular flowers, which preceded the others by about four days.

The reason for this I attribute to the attempt of the flowers to secure pollination. The plant was kept in a room, and while the flowers were few in number there was no chance for the transfer of pollen, as was easily the case when they became more numerous and crowded. The stamens appeared to wilt in about two days after their pollen had been thrust out by the styles and had they, as was observed in later cases, drawn the styles down into the tube with them, then the object of their living would have been defeated. In two cases I transferred pollen to the stigmas and no movement of the styles was noticed independent of the stamens, but after a time both styles and stamens were drawn down within the tube. My conclusion is that undoubtedly the first cases failed of fertilization and the withdrawing of the styles and the subsequent unfolding of the style branches was a plan to longer present their stigmas for the reception of pollen.—WALTER H. EVANS, *Herbarium Eli Lilly & Co., Indianapolis.*

An abnormal water-pore.— The accompanying figure illustrates a curious water-pore found by Mr. E. L. Hicks, a student in the botanical laboratory of the University of Wisconsin, while examining these structures on the leaves of *Tropæolum majus*. The four guard cells bound a somewhat trapezoidal pore, *A*. The whole apparatus reminds one strikingly of a stoma of *Marchantia polymorpha*. That it was a functionally active pore was shown by the distinct incrustation of the guard-cells with mineral salts.—C. R. B.



A new grass: Melica? multinervosa.— Culms from a strong creeping rhizoma, about 3 ft. high, somewhat thickened at the base, erect, smooth, frequently geniculate below, the lower nodes hairy: leaves four or five, narrow, rather rigid, 6 to 12 in. long, becoming involute; lower sheaths much longer than the internodes and open above, upper sheaths shorter; ligule a prominent ring of hairs: panicle erect, 6 inches long, the branches single, the lower ones 3 inches long, flowering above the middle with 3 to 6 single, alternate, short-pedicelled, approximate spikelets, the upper branches gradually shorter, above nearly sessile, the lower branches spreading somewhat in flowering; rachis angular, scabrous, hairy in the main axils: spikelets spindle-shaped or linear-lanceolate, 6 to 9 lines long, 8 to 12-flowered, slightly compressed, the flowers imbricated, purple on the margins; empty glumes somewhat unequal, the lower 2 lines long, 1- or faintly 3-nerved, the upper 7-nerved, both

ovate, acutish, not keeled, coriaceous, smooth; flowering glumes ovate, acutish, slightly thinner than the empty glumes, rounded on the back, about 7-nerved, 2½ to 3 lines long, pubescent on the margins and back below, and thickly pubescent on the rachilla; palet ovate, about 2 lines long, in maturity divided to the base, the two keels winged: stamens 3, included; stigmas 2, plumose; grain concavo-convex, roundish, the 2 thin margins incurved, the 2 thickened styles persistent at the summit.

Collected at Brazos Santiago, Texas, by *G. C. Nealley*, 1891. I place this species doubtfully in Melica, although it differs in several particulars from any species of that genus with which I am acquainted. First, the empty glumes are rather thicker than the flowering ones; second, the upper glume is 7- to 9-nerved; third, the upper flowers of the spikelet are not club-shaped; fourth, the base of the flowering glume and the rachilla are densely pubescent; fifth, the ovary is roundish in outline, concavo-convex with the margins incurved, and 2 thick horn-like styles.—GEORGE VASEY, *Washington, D. C.*

Fasciation in Cnicus lanceolatus.—The most peculiar case of fasciation that ever came under my notice is that of a common thistle (*Cnicus lanceolatus* Hoffm.) recently obtained from Grand Traverse county, in Michigan. The accompanying cut will give some idea of its shape. The specimen where cut off, a few inches above the ground, is 3¼ inches wide. Its greatest width is 11½ inches, the average width being a little over 7 inches and nowhere more than an inch thick. The plant is 3 ft. 7 in. high including the bending top. It does not branch, but for the most part the broad stem is well covered with leaves. The numerous flower heads are sessile or nearly so at the very summit.—J. W. TOUMEY, *Botanical Laboratory, Mich. Agr'l College.*

A new Eriogynia. Notes. — **Eriogynia** (*Petrophytum*, Nuttall) **Hendersoni** n. sp.—A depressed branched plant more or less pilose; leaves green, very slightly if at all sericeous, half to one inch long, spatulate, somewhat abruptly acute, thick, three-ribbed beneath, those of the scapes very small and few, resembling bracts; inflorescence racemose,

much more open and loose than in *E. cæspitosa* Watson; pedicels three lines long, usually with a small bract midway, but these sometimes basal on the lowest; calyx-lobes oval, obtuse; disk hairy within, about the length of the calyx-tube and adnate to it except the free crenulate edge—the twenty-five or more stamens inserted just outside the margin; carpels five, each two- to four-ovuled, one- or two-seeded, hairy along the inner edge, oblong-obovate to ovate, the rather rigid styles bent outward; filaments filiform or slightly flattened at the base; petals white, smooth, oblong to nearly orbicular, unguiculate, nearly as long as the stamens; seeds linear; scapes three or four inches high.

An interesting plant, nearest to *E. cæspitosa* Watson, differing especially in the smoother, more robust habit, the shorter and proportionally broader carpels, the shorter and stouter styles and the thick, three-nerved leaves. Except the inflorescence the general habit resembles that of Arctostaphylos alpina. It was discovered on vertical cliffs near the summit of the Olympic Mountains, Washington, at an altitude of 7,500 ft., July 15, 1890, by Prof. L. F. Henderson, for whom it is named; and was also collected in the same region on Sept. 30 following, by Mr. Charles V. Piper.

Mr. J. W. Blankinship collected, July 7th, 1890, in the Big Horn Mountains, Wyoming, at an altitude of 10,000 ft. what seems to be good *Erigeron Tweedyana* Canby & Rose.

Prof. E. L. Greene has issued some advance sheets of Pittonia, vol. ii, pp. 159–166, July 1st, 1891. On page 162, a plant is described as new under the name of *Tellima nudicaulis*. This is evidently the same as Nos. 119 and 52b of the collections of the Northern Transcontinental Survey, distributed by me under the MS. name of *Tellima pentandra* and which Prof. D. C. Eaton described as *Heuchera Williamsii* in BOTANICAL GAZETTE, vol. xv. p. 62 (March, 1890). If a Tellima—and I still think it accords better with that genus than with Heuchera—it should probably bear the original name of *T. pentandra*, as given in Prof. Eaton's article. Some botanists, however, may insist on using the specific name which it bears under Heuchera, in which case it would be *T. Williamsii*.—WM. M. CANBY, *Wilmington, Del.*

EDITORIAL.

THERE IS a certain fixity necessary in the terms which are used in descriptive botany; yet if anyone will compare descriptions of plants written 100 — or even 50 — years ago with modern ones the changes that have occurred in terminology will be striking. These changes have crept in almost unperceived in most cases, and have been made in deference to modifications in the morphological concepts. But if the list of terms now in use be scrutinized it will be seen that many do not in the least correspond to the present views of the morphology of the parts. Note for example the terms relating to the flower mentioned by Prof. MacMillan at p. 178; and further such as acaulescent, adnate (anthers), albumen and plumule for the Phanerogams; stipe and frond for the Ferns; areolation, apophysis and acrocarpous for the Mosses; and a host of others that might be specified.

WHAT SHALL be done with such terms? Drop them and substitute the more correct ones, says the morphologist; whereat the systematist raises his hands in holy horror, because the necessity for change does not appear. Nor it is likely that it can be made obvious to him. He is looking at the blue side of the shield; the morphologist at the white. Here is an opportunity for the botanical congress of 1893. It may wisely undertake not only to unite systematists in some common action regarding nomenclature, but take steps toward revising the inconsistent terminology of the science.

WE SAY "of the *science*," for morphology is by no means guiltless in this matter. The most thorough attempt to revise the terminology of the reproductive organs of cryptogams was made a few years ago by Bennett and Murray. Though not wholly consistent nor wise, the move was in the right direction and their suggestions might serve as a basis for future revision.

CURRENT LITERATURE.

The Podostemaceæ.

Warming's paper on this family[1] contains an admirable account of the characters of this small, but very interesting family, the position of which, formerly in dispute, the author states to be close to the *Saxifragaceæ*. Several years ago Mr. Warming made a special study of this family, and the present paper contains most of the results of the investigations, which have been made with his usual acuteness in morphological and anatomical questions. The structure of the vege-

[1] WARMING, EUG.— Podostemaceæ in Engler und Prantl: Die natuerlichen Pflanzenfamilien III. 2. a. Leipzig: Wilhelm Engelmann. September, 1890.

tative organs is peculiar. The roots of these plants show in several species a function, corresponding to that of a rhizome, and have hitherto often been considered as identical with a "thallus" or a "stem." They are always dorsiventral and often strongly flattened; one genus, *Tristicha*, is, however, according to Cario evidently destitute of any kind of roots. As to the internal structure of the roots, there is neither any endodermis nor pericycle, but the central-cylinder is surrounded by a collenchymatic tissue, which is especially strongly developed on the dorsal face; the groups of leptome occupy the dorsal face of the central-cylinder, and are not in alternation with the groups of hadrome, here being situated on the ventral face. The groups of hadrome, commonly two, contain a few narrow vessels, but seem, however, in some cases to be entirely wanting, thus the cylinder looks as if it merely consisted of leptome. The roots showed otherwise a more or less large-celled parenchyma with deposits of starch.

Two different kinds of organs have been observed as fixing the roots to the substratum: "hairs" with the structure of true roothairs, but with the properties of rhizoids; and the so called "hapters." These last organs have been described more completely in a special paper by the same author[1]. They are exogenous and are constantly developed from the base of the shoots; they show a conical shape as long as they have not yet reached the substratum, but after that they become flattened and show usually a more or less digitate lobation, the lobes closely fastened to the substratum, and exuding a brownish secretion. These "hapters," which remind one very much of similar organs of the *Fucaceæ* and *Laminariaceæ* show a very simple structure, consisting merely of a parenchymatic tissue, in which the author observed the presence of siliceous concretions. The hapters have no root-cap, but are able to regenerate like true roots.

The shoots are developed in acropetal succession from the sides of the flattened roots, or in some cases a little towards the ventral face; they appear usually in pairs, more or less opposite, and are developed from the outermost layer of the bark, without being in contact with the central-cylinder. They resemble the roots fixed to the substratum by rhizoids and hapters, and are more or less dorsiventral.

The leaves show a great variation in size and shape; the first developed are scale-like, succeeded by the mostly alternating proper leaves, the blade of which may vary from simple and very small as in *Tristicha* and several species of *Podostemon*, until larger and deeply cleft as in most species of this family.

The paper is illustrated by 17 figures, mostly original and finely drawn by the author himself.— THEO. HOLM.

[1] Botanische Notizen. Bot. Zeitung, 1883.

Forest trees of North America.[1]

This brochure of plates will come as a surprise to almost every botanist. Very few, even of Dr. Gray's friends, were aware of the existence of these plates or of the projected work which they were intended to illustrate. They were stored at his house and after his death were sent to the Smithsonian Institution whose property they were. The 300 copies are now "distributed to the principal botanists and museums of the world as mementos of the distinguished man who gave so much of his life and labors to this department of knowledge." The few plates now published (from Mr. Isaac Sprague's admirable drawing) make us wish that the expensiveness of the undertaking and Dr. Gray's preoccupation had not prevented the preparation of text and the completion of the work. We may well congratulate ourselves, however, that the Secretary of the Smithsonian Institution has authorized the distribution of them, even in their incompleteness.

Botanist's Directory.

The useful Correspondance Botanique of Morren having become antiquated Wilhelm Engelmann of Leipzig, the well-known publisher, has issued a list of living botanists, of botanical institutes, societies and periodicals[2].

The compilers are hidden behind the term "Fachmänner." Of course one looks first at the addresses of his own countrymen. For the United States we find many of them sadly awry, and it is a pity that the MS. or the proof was not submitted to some American "Fachmann." We could name a dozen who could have corrected three-fourths of the errors and have added many names worthy of insertion. However, the main value of the book to Americans lies not so much in the accuracy of the American addresses as in those of foreigners. We may well believe that for the continent of Europe at least the work much surpasses in fullness and accuracy the United States section. It is sure to prove of great use to all who have any European correspondence or who wish to be able to distribute papers or specimens wisely. The addresses are grouped by cities, and an index of persons and one of places at the end enables one to find any address of which he has even an inkling. The publisher will be grateful for notice of corrections. We hope that American botanists will see to it that their addresses are correctly given in future editions.

[1] Botanisches Adressbuch. Verzeichnis der lebenden Botaniker, sowie der botanischen Anstalten, Gesellschaften und Zeitschriften, herausgeben von Fachmænnern. 8 vo. pp. 186. Leipzig: Wm. Engelmann, 1891.— M. 5.

[2] GRAY, ASA.—Plates prepared between the years 1849 and 1859, to accompany a report on the forest trees of North America. 4°. pp. 4. plates 23, colored. Washington: Smithsonian Institution. 1891.

OPEN LETTERS.

The home of Calypso.

Some years ago, while making a botanical exchange with Prof. W. W. Bailey, the poet-botanist of Rhode Island, I was accused by him of prodigality, because I sent him so many specimens of Calypso borealis. But I could then afford to be prodigal, for I was located in the very court of the goddess, viz:—the cedar region of northern Vermont.

Two years ago I met, at his summer home under the shadow of Mt. Lafayette, the genial author, botanist and world-wide traveler, Dr. Prime. To him I boasted that in half a day I could gather, in Caledonia Co., Vt., fifty specimens of Calypso. He thought that, in Essex Co., he could, in the same length of time, gather a hundred. The two counties are adjacent, and cold, cedar swamps abound in both. Even there it must be reckoned as a very rare plant; but I have wondered if, in any other state, it is as little rare. It is found in Maine, on the Mohawk, in Wisconsin and Minnesota, in Oregon and Washington, and in the British provinces. But, if one may judge by the parsimony which most collectors evince in parting with specimens, it is nowhere found as plentiful as in the locality mentioned.

It prefers the shade of the arbor-vitæ. It grows on low, moist ground — not wet ground — but on knolls a foot or so above the swamp level. A mass of dead Sphagnum overgrown by a thick layer of Hypnum is its favorite bed. The corm and roots rest entirely in the moss, seeming to have little or no connection with the underlying humus. Two or more corms are often united, the one of the preceding year persisting.

Though searching carefully, I have never found fruit. This must be from lack of fertilization by insects. At the blooming season — May 15 to May 30 — there are few insects abroad. I have never seen one hovering about Calypso.

The pressed specimen gives but a poor idea of the beauty of the flower. Pressing usually throws the lip up out of position, giving it a ringent, flaunting, turn-up-your-nose sort of a look, but as it grows, the lip is obliquely pendant — as much so as that of Cypripedium acaule. Dainty beauty is the fitting title. It is comparable only to a bright, modest girl dressed in pink. In Wood's Class-Book of Botany (1846), the flower is said to be as "large as that of a Cypripedium". He must have had Cypripedium arietinum in mind, for no other species of native Cypripedium has a flower so small. Of forty specimens of Calypso, the length of lip averages less than three-quarters of an inch, and in some it is barely half an inch. The same specimens give, average height of plant, including corm, 4.9 inches: average length of leaf-blade, 1.3 inches: average width, 1.1 in. Of these, three have two flowering stalks, apparently from the same corm.

Some stations in Vermont where Calypso was formerly found are known to be exhausted owing to clearing of the woodland, but there is comparatively little danger of its extinction in the region of which I speak. In spite of its pink perianth, it is hard to find, and an expert collector might pass it by unseen. Moreover, many of its haunts are likely to be left in timber perpetually. So I think that northern

Vermont may fairly be called the home of Calypso, but if some botanist between Sitka and Superior shall write me that he finds Calypso as common as Carex — why, I congratulate him, that's all.— F. BLANCHARD, *Washington, D. C.*— [See p. 230. EDS.]

NOTES AND NEWS.

J. W. TOUMEY has been elected botanist to the state college and experiment station at Tucson, Arizona.

THE LAST part of a key to the genera and species of British mosses by Rev. H. G. Jameson appears in the July *Journal of Botany*.

THE SUMMER school of botany at Harvard University closed August 1 a very successful 5-weeks session. About 20 were in attendance.

PROF. DR. KARL von Nägeli, of the University of Munich, author of many valuable botanical works, and a philosophical botanist of deep insight, is dead at 74 years of age.

THE LIBRARY of the late Dr. Schenk and that of Dr. Karl Sanio, who died last February, have been purchased by Weigel (Leipzig) and the works will shortly be offered for sale.

DR. EDWARD PALMER, the well known collector, started about the middle of July for a year's exploration of western Mexico. His friends will be glad to know that he is much improved in health and anticipates a very profitable year of work.

VON TUBEUF has lately published a book[1] which contains good and practical hints as to the identification of German forest-trees at a stage shortly after the germination, together with descriptions of the fruits and seeds of the same trees. Although strictly confined to the native or cultivated forest-trees of Germany, the book might undoubtedly be of some interest and use also to American students in this line.— T. H.

C. SAUVAGEAU has made a very comprehensive study of the leaf-structure of the *Potamogetonaceæ*.[2] The principal purpose of his investigations were not only to give a general sketch of the internal structure of the leaf, but also to show the importance of anatomical characters in identifying species, when represented merely by fragments; and finally to illustrate the relation between structure and medium. After giving some introductory remarks concerning the classification of this group and the general influence of medium upon structure, the author describes and figures the leaf-structure of representatives of the *Zostereæ*, *Posidoniæ*, *Potamogetoneæ*, *Cymodoceæ* and *Zannichellieæ*. The paper contains several new observations besides valuable references and comparisons with similar studies, made by others.—T. H.

[1] Samen, Fruechte und Keimlinge der in Deutschland heimischen oder eingefuhrten forstlichen Culturpflanzen. Berlin, 1891.

[2] Sur les feuilles de quelques Monocotylédones aquatiques. *Dissert.* pp. 200. Paris, 1891.

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